

# A Survey of Waste Management Analysis in Afghanistan

<sup>1</sup>Rahmatullah Mangal, <sup>2</sup>Khalid Pashtoon, <sup>3</sup>Sharafdin Sharaf,  
<sup>123</sup>Assistant Professor,  
Shaikh Zayed University.

## Abstract

Sharp increase in the rate of social and economic factors, has increased the rate of urbanization in most of cities around the world. This global phenomenon is one of the primary reasons for waste generation cities. The basic purpose of this descriptive study is, to analyze and identify waste management problems in Kandahar city, and propose decent solutions. The study is based on primary and secondary data, which were collected through a structure questionnaire, interview and other tools of data collection. The data were analyzed with the help of various means of descriptive statistic. The finding shows that that people are not satisfied with current waste management services. The study suggests, that municipality should improve the design and number of trash bins, increase the number of tracks hire more employees, hire a team of evaluation, set up modern technology and improve research skills.

## Introduction

Waste is any material of no use that is regularly generated by the society. (Mishra<sup>1</sup>, Mishra<sup>2</sup>, & Tiwari<sup>3</sup>, 2013). Based on a report of World Bank, the annual estimated generation of waste was 1.3 Billion tons in 2012, which is equal to 1.2 kg/day (Bhada-Tata & Hoornweg, 2012). As illustrated in Table1, waste generation has positive relation with both urbanization and economic activities (Shekdar, 2009). It means that sharp increase in the rate of social and economic factors, is increasing the rate of urbanization, high urbanization rate surges economic growth, which is the main cause of increasing personal income and standards of living. The increase level of standards of living means demanding more goods and services, which is the primary cause of waste generation (Bhada-Tata & Hoornweg, 2012). The increasing rate of waste, endangers the safety of the environment and the public health (Zue, Asnani, Zurbrügg, Anapolsky, & Mani, 2008). Thus, efficient waste management is considered as a significant for phenomena for every city.

Unfortunately, waste is growing at a higher rate in comparison to the actions and resources of responsible organization (Ogwueleka, 2012) . It is currently considered as a major concern for most countries, especially, for most of developing nations, with increasing population, improper waste management policies, lack of appropriate technology, and low literacy rate (Diaz, 2016).

Table: 1

Information on GDP, waste quantity and composition for some Asian countries.

Country	GDP (PPP) per capita estimated for 2007 (USD)	Waste generation (kg/capita/day)	Composition (% wet weight basis)						
			Biodegradable	Paper	Plastic	Glass	Metal	Textile/leather	Inert and other
Hong Kong	37,385	2.25	38	26	19	3	2	3	9
Japan	33,010	1.1	26	46	9	7	8	–	12
Singapore	31,165	1.1	44.4	28.3	11.8	4.1	4.8		6.6
Taiwan	31,040	0.667	31	26	22	7	4	9	
South Korea	23,331	1.0	25	26	7	4	9	29	
Malaysia	12,702	0.5–0.8	40	15	15	4	3	3	20
Thailand	9426	1.1	48.6	14.6	13.9	5.1	3.6		14.2
China	8854	0.8	35.8	3.7	3.8	2	0.3		47.5
Philippines	5409	0.3–0.7	41.6	19.5	13.8	2.5	4.8		17.9
Indonesia	5096	0.8–1	74	10	8	2	2	2	2
Sri Lanka	5047	0.2–0.9	76.4	10.6	5.7	1.3	1.3		4.7
India	3794	0.3–0.6	42	6	4	2	2	4	40
Vietnam	3502	0.55	58	4	5.6	1.6	1.5	1.8	27.5
Laos PDR	2260	0.7	54.3	3.3	7.8	8.5	3.8		22.5
Nepal	1760	0.2–0.5	80	7	2.5	3	0.5		7

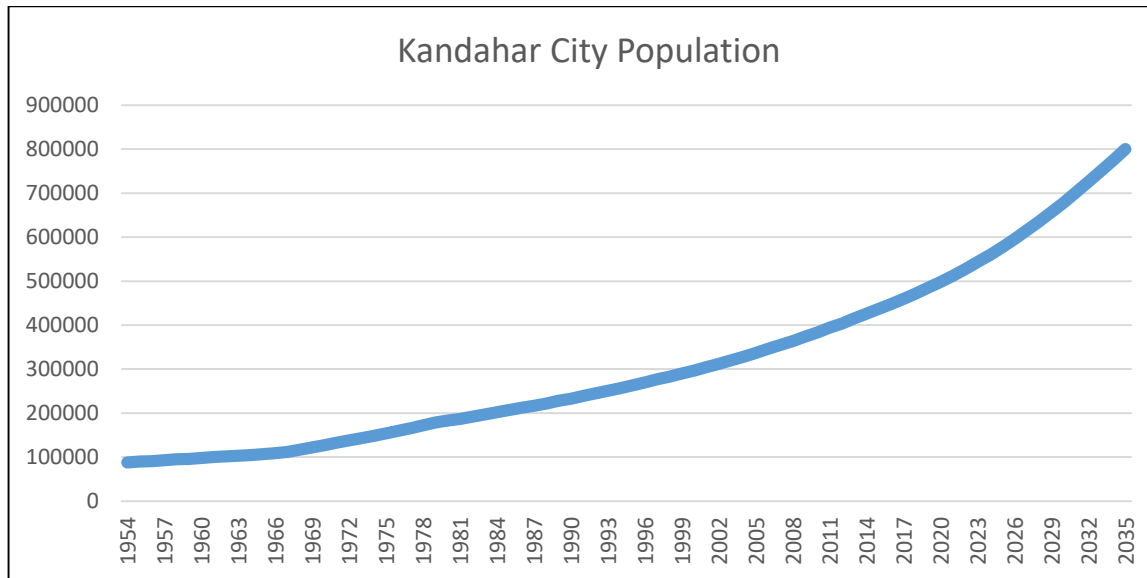
Source: Shekdar, 2009

The complex structure of the waste, make it more difficult for municipal, to manage things properly (India-UNDP Project, 2015). The United Nations Department of Economic and Social Affairs (UNDESA) claimed that authorities responsible for waste management and environmental problems, will be successful, if they choose a complete and more organized way of managing solid waste. They further emphasize, that It is necessary to prevent, reduce and recycle waste rather than, coping with rapid growth of waste continually (Modak, Jiemian, Hongyuan, & Mohanty, 2012).

Afghanistan, a war torn, developing country has experienced a sharp growth in various sector since 2001 (Shroder, 2008). Even though the growth has noticeable positive impacts on Afghans life, the country is now facing a serious challenge in term of managing waste (UNEP, 2019). Most cities in Afghanistan do not have access to well-organized structure of technology and efficient management skills, because of which most of the biggest cities, including capital of Afghanistan are facing many complications, in terms of managing solid waste (Rahmani & Noori, 2019).

Among other cities of Afghanistan, Kandahar is the second largest city of Afghanistan. It is one of the fast-growing provinces and is bothering from its worse waste management system, the city is faced with the challenge of weak community participation, lack of regular streets and high urbanization rate as it is shown in figure 1 (Sahil, 2017). Moreover, the city does not have a sustainable waste management system, the municipality is collecting and disposing its municipal solid waste in a traditional way (Rahmani & Noori, 2019). The municipality and other supporting organizations are working together to find a solution and develop a proper and sustainable waste management system in the city (Rahmani & Noori, 2019).

Figure 1



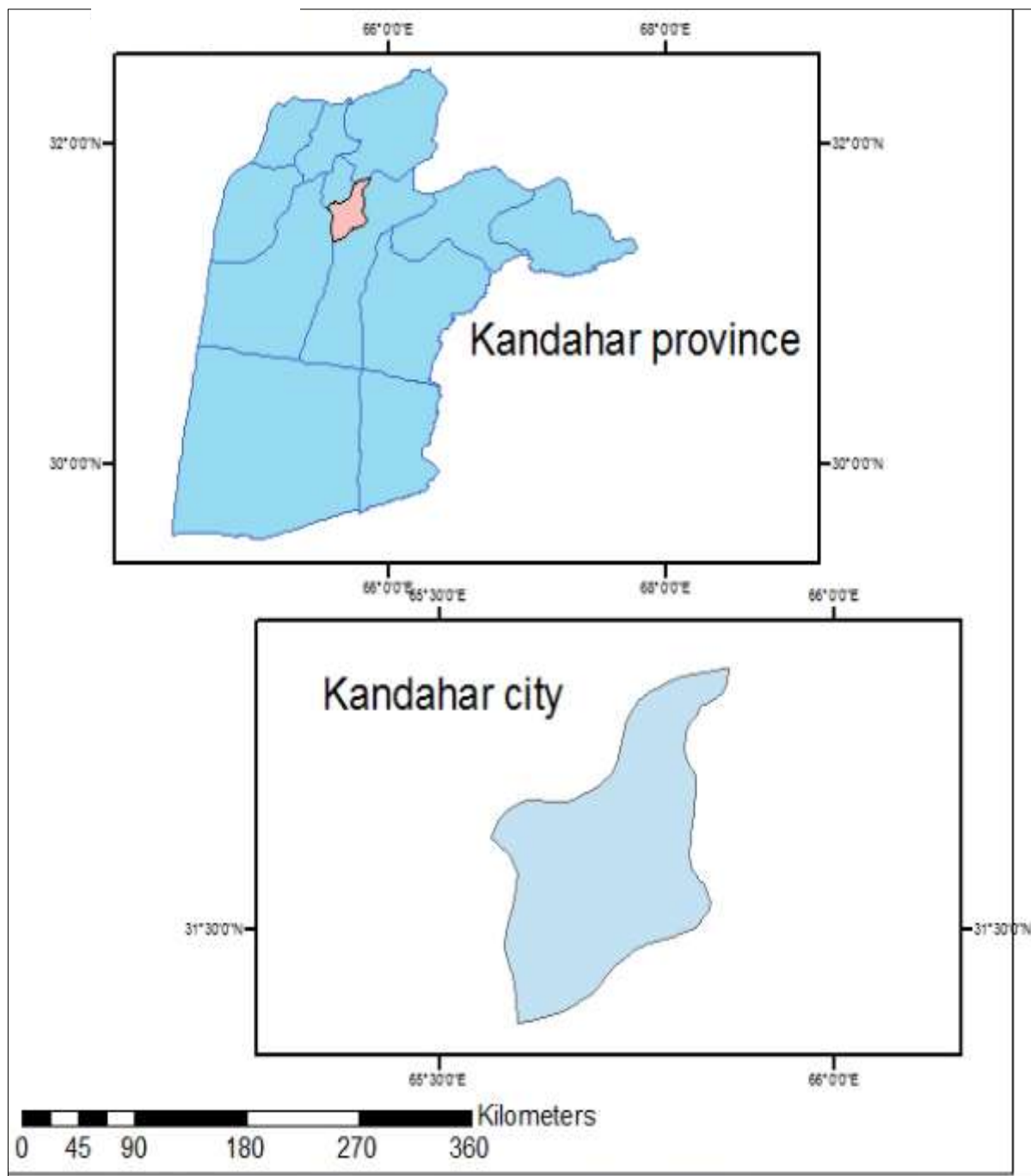
Source: Population stat

Fortunately, there are many successful examples available, in term of efficient waste management, from which the municipalities can find a better solution for the problem they are facing (Wilson, Rodic, Scheinberg, Velis, & Alabaster, 2010). Navi Mumbai, for example, is a city developed in 1972, at North West of Mumbai, India can be a good illustration for many countries in the world, especially for developing countries (Navi Municipal Corporation, 2018). Although the city has experienced a rapid growth in both population and economic activities, the city still has an efficient system for managing waste and environmental concerns (Joelsson & Lord, 2016).

The basic purpose of this descriptive study is, to analyze and identify waste management problems in Kandahar city, and propose decent solutions. Moreover, the study seeks to point out important principles for a sound solid waste management. The analysis and results of the study will help municipality and supporting organization, to make good decisions for managing municipal solid waste.

### A Succinct of Kandahar city

Kandahar city is the capital of Kandahar province, a south-western, border province of Afghanistan (A Project of UNDP/OPS & UNOCA, 1991). The city is placed in  $65^{\circ} 35' - 65^{\circ} 48' E$  longitudes and  $31^{\circ} 25' - 31^{\circ} 50' N$  latitudes, with a height of 5100 meters from mean sea level (MSL), with an area of 250 square kilometers and population of 498000 (Populationstat, 2020; Haziq & Panezai, 2017). Migration as a major reason is playing an important role in continues growth of city population (Saeedi, 2019).



**Figure 2. Location of Study Area**

### **Waste Management Process:**

Waste management is a systematic process of several functions, which includes, waste collection, conveying, processing, recycling and disposing (Lamb, Pogson, & Schliebs, 2012). Currently, almost all cities are practicing the same process for managing waste. However, most of these cities are not successful, and they still have to go a long way to adopt an efficient waste management (Amasuomo & Baird, 2016). Kandahar city is also in the list of those cities, which is bothered from the absence of having a well-organized waste management procedure. The municipality, in Kandahar city, is currently practicing a five-step procedure of collection, transportation, Segregation, recycling and disposing. Yet, the procedure is not that much more mature and efficient, as it is, in other developed cities of the world. The process is illustrated in the figure 2.

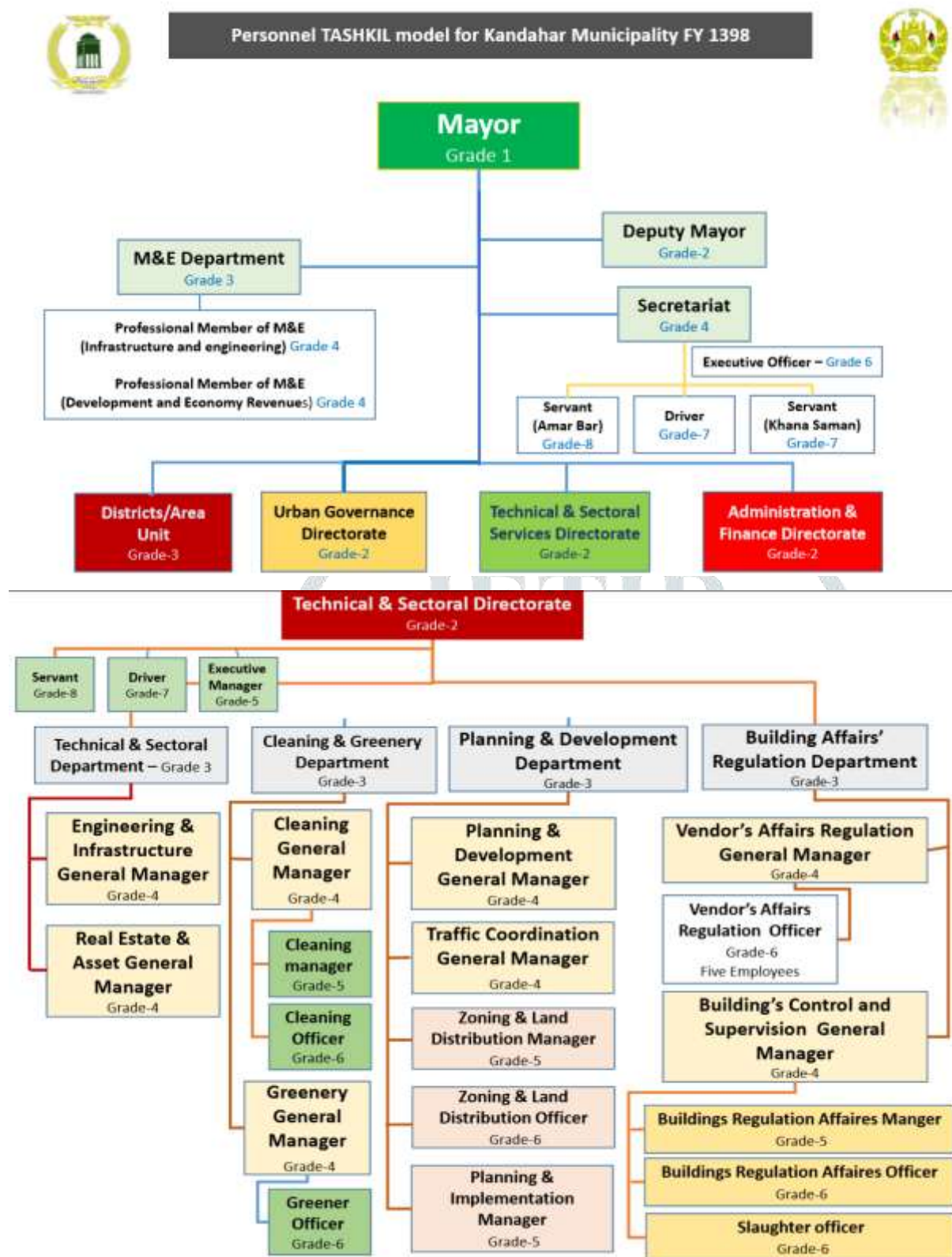


**Figure 3**

#### **Corporate structure of Waste Management:**

A department is operating under the authority of Kandahar city Municipality. It is the only public representing department, which is responsible for waste management in the city. Although there are several opportunities of investment, private still does not have interest to invest in this particular field. All process of managing waste is the responsibility of waste management department. The diagram below deliberates the organizational structure of accountable department.





### Methodology

This is a study of waste management, subjected to Kandahar city, which is located in the center of Kandahar province. The study focuses on waste management to identify consisting problems and seeks to offer efficient solution for many problems in connection with waste management. To do so, the study takes advantage of different valid and reliable techniques for data collection, in order to collect, both primary and secondary data from various reliable sources, which are directly or indirectly involved in the process of waste management. Primary data was collected through a structure questionnaire from households, waste collectors, small business owner, municipal authorities, and from other agencies responsible for managing wastes. The population of the

city is 498000 people, with an average of 8 members for each family a random sample of 400 participants with 5% error was selected and surveyed based on Slovin's formula of selecting a random sample from population

$$n = \frac{N}{1 + Ne^2}$$

Where, n represent number of participant or sample, N represent total population and e stands for limited error. The data were collected, for the purpose of analyzing the nature, generation and collection of wastes which are considered as the initial and important steps for waste management process. The selected sample was further divided by 10 districts based on the residents, living in each district. The portion of each district is reflected in Table 2. Facts and figures, regarding other important stages (Transportation, Disposal and Segregation) were collected with a method of interviewing workers and municipal authorities in charge of managing wastes.

Table 2			
District	Population	Total Household	Household Surveyed
District 1	76600	10632	35
District 2	40819	12277	50
District 3	67010	10500	35
District 4	34908	6900	25
District 5	29710	4800	25
District 6	40819	4795	25
District 7	46650	4494	25
District 8	43730	5293	30
District 9	78684	28000	100
District 10	39070	11791	50
<b>Total</b>	<b>498000</b>	<b>99482</b>	<b>400</b>

Secondary data, as a second important source of information, were collected from several reliable sources. These sources involve, waste management related articles of scientific journals, scientific reports, strategic plans, books and several websites describing waste management including Kandahar municipality website. All sources are cited in a proper American Psychological Association (APA) Manner.

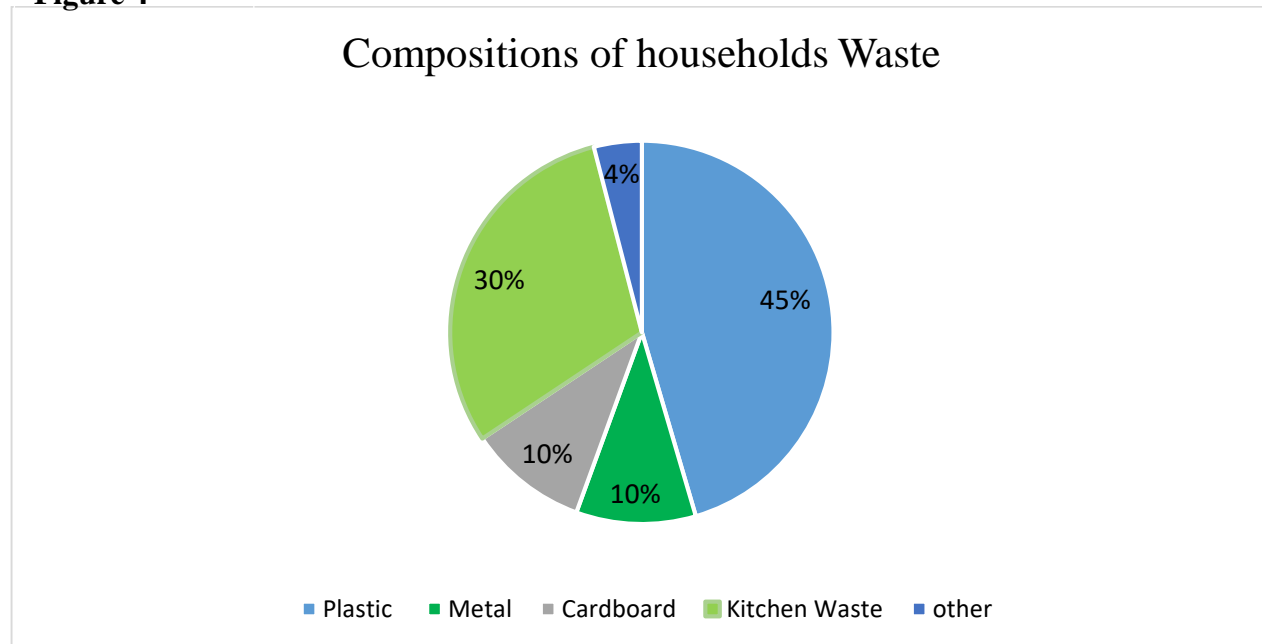
### Data Analysis:

Data were collected for various influencing factors, which can easily describe and analyze, the problems and solutions of current waste management in Kandahar city. Collected data were described, through several means of descriptive statistics, such as, frequency, mean and percentage. Moreover, a number of graphs, diagrams, tables and pictures were used for visualizing and simplifying the collected data.

### Findings

Among other cities of Afghanistan, Kandahar city is an insecure city of the country. War, lack of proper infrastructure, low literacy rate and corruption are considered as the main backing reasons. Although the city is bothering from instable economic and political circumstances since a long time, it still has a high rate of population and economic growth, which is mainly because of strategic and economic location of the city.

Waste management is one of the prevalent concerns in this city. This study attempts to reflect several factors, which are directly or indirectly influencing waste management, for analyzing dominant waste problems. The survey found that plastic covers a huge percentage of 45 in the waste that are generated by household. Moreover, it found that kitchen waste or organic material, containing 30 percent of the total wastes, was the second major component of household daily waste. Both cardboard and kitchen waste stand for just 10 percent of waste, which is because of informal recycling by household and other parties.

**Figure 4**

The data collected from Kandahar city showed, that an average of 100 trucks of waste are generated every day. Each of the truck is caring an average of 8 tons. Thus, the total amount of daily waste is equal to 800 tons or 725748 Kgs. Considering the whole population of the city, which is 498000 and the collected data subjected to household waste compositions, it is easy to analyze and interpret, per capita waste, both in terms of whole waste and components of waste in the city. The calculation is reflected in table 3 below.

**Table 3**

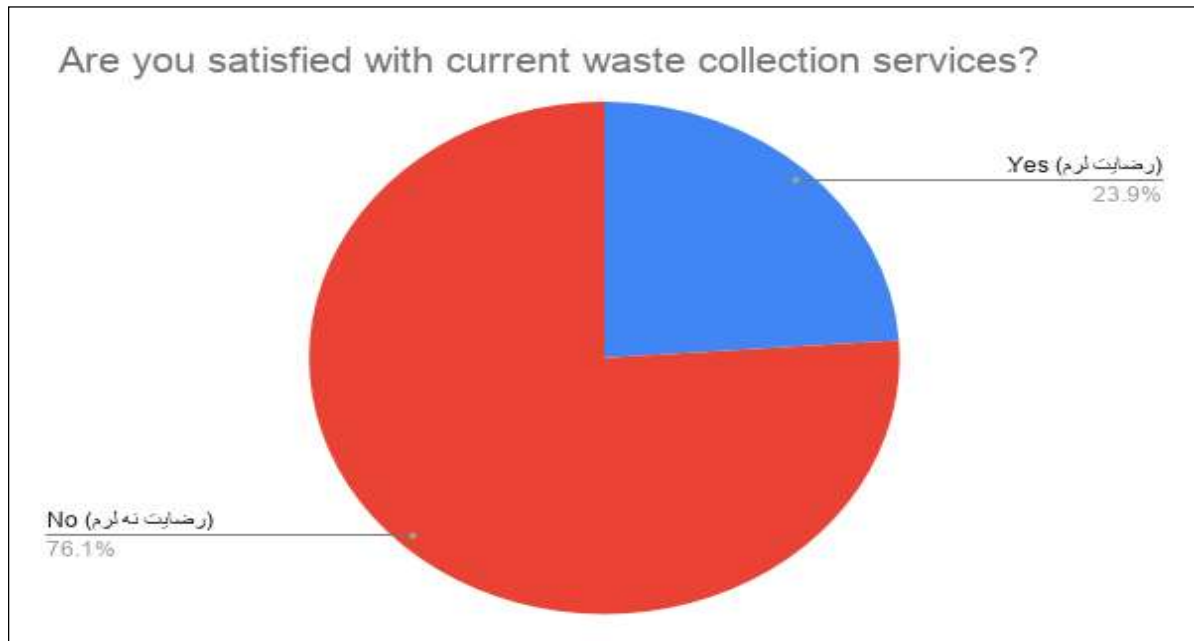
Description	Amount in Kgs
Average waste Generation per day	453592
Waste per capita	0.910827309
Plastic per capita	0.409872289
Organic waste per capita	0.273248193
Metal per capita	0.091082731
Cardboard per capita	0.040987229

Information collected from all districts describes, that people are not satisfied with current waste management services provided by the municipality of the city. The survey, as it is illustrated in chart figure 4 below, concluded, that more than 76 % people are not happy with current provided services. There are several reasons because of which people were not satisfied with the services provided by the municipality of the city. For

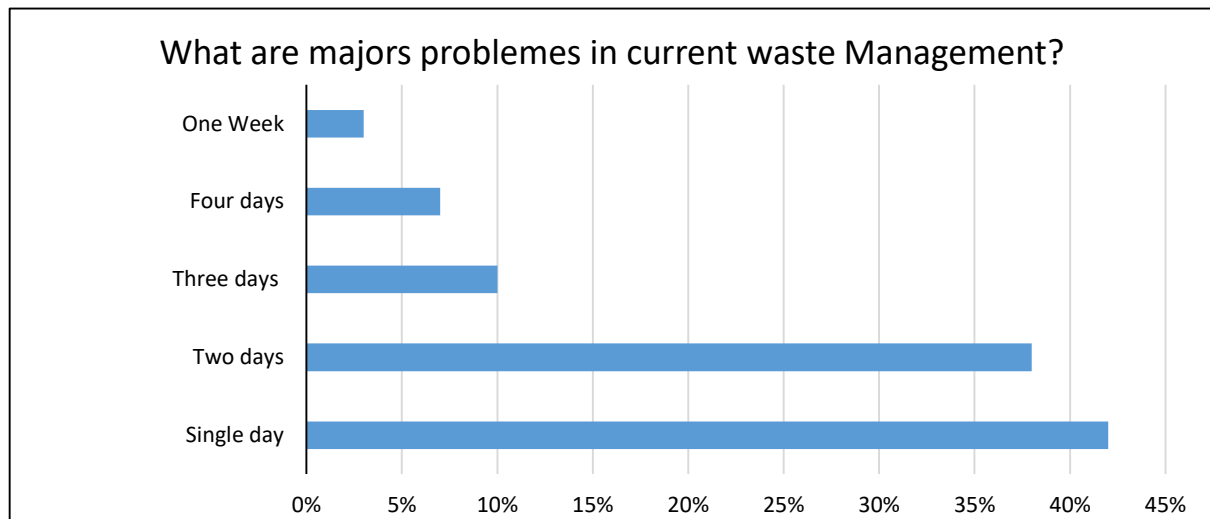
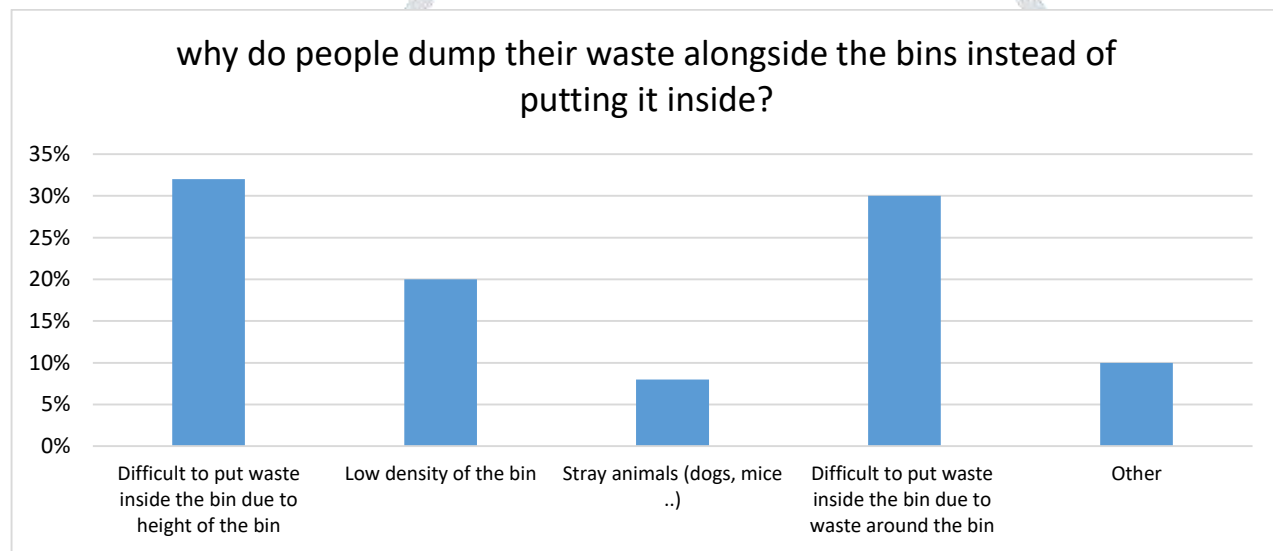


instance, the distance and time gap are as reflected in figure 5 are major concerns of people. The municipality has installed 700 trash bins in the city, which lays in area of 250skm and each household has an average distance of 350 meter from the trash bin. Thus, many households, which are far from the trash bin, dispose their waste in open space. On the other hand, households near trash bin are not happy with time gap between two periods of conveyance.

**Figure 5**



Waste, alongside the bin was another major problem underlined by people. They were complaining from the height and surrounding waste of the trash bin. The bin has a height of 5Fts, and it is difficult for people to put their waste inside the trash bin. Moreover, the waste around the trash bin make it difficult for people to put waste inside the trash bin. Both of the above-mentioned problems, as illustrated in figure 6, were highlighted by 32 and 30 percent of the total population in the survey.

**Figure 6****Figure7**

### **Suggested Ways to an efficient waste management:**

The survey is not only analyzing problems, it also tries to provide solution for various problems, so that, the municipality and other responsible parties will be able to reach the goal of having an efficient waste management. The survey suggests following solutions for the problems that are highlighted in the survey.

#### **1: Refining Trash bins**

Trash bins are very important for a well-organized waste management system. Most of the participants were complaining from about problems in this particular stage of managing waste. For instance, a huge percentage of population were unhappy with the design and number of trash bins. Because of which, many households were putting their waste in an open space, Thus, municipality, as a unique service provider, should improve the design and number of trash bins. Moreover, they should try to introduce trash bins of different colors for each type of waste, so that, both municipality and households will be able to separate and recycle waste easily.

#### **2: Hiring More Employees**

Kandahar municipality has hired 340 employees to manage waste in the city. However, both people and municipality are supporting the idea, that current staff is not enough for the city. The municipality claimed, that they do not have enough resources to hire additional employees. Most participant of the survey suggested that

municipality should seek financial resources and solve their problems. The survey further suggested, that municipality can take advantage of planning volunteer programs in different district of the city. Majority of the people in sample as reflected in the figure below agreed to be volunteer for a day or two each month.

### **3: Managing Waste Transportation**

Improper conveyance of waste was another highlighted problem. Most of the participant were accusing municipality for low frequency of waste transportation and uncover tracks. They were also complaining about the way of cleaning the bin and the surrounded field. Thus, municipality should increase the number of tracks for increasing the frequency of transportation. Additionally, they should hire a team of evaluation in each district of the city for controlling and accessing both households and transportation team.

### **4: Increasing public awareness**

The survey found that literacy rate is low in the city and it is a cause that majority of the citizen are not supporting municipality in terms of completing their own responsibility as a citizen. The municipality should use different means of communication (Social media, TV, Radio, and Newspaper ...) and encourage influential personalities such as Islamic scholars and academic institutes to increase public awareness.

### **5: Public Private Partnership (PPP)**

Public Private Partnership is a good tool for developing efficient waste management. Unfortunately, Kandahar municipality does not have any partnership, in terms of managing waste, with any private identity, even though, there are good opportunities of investment. The municipality can motivate business men to PPP. It will increase financial resources for municipality and will be a good solution for many problems.

### **6: Levying service Fee:**

Service fee is an important source of financing in most of the cities around the world. However, Kandahar municipality does not have a regular structure of service income from waste management services. The survey found that each family can pay an average amount of 150 AFN for better services. The municipality can impose an amount to enrich their resources and provide better services.

### **7: Recycling**

Recycling is an ecofriendly and effective technique of managing waste. It is the basic reason behind the success of many municipalities, with efficient waste management process. Unfortunately, Kandahar municipality does not have a good method of recycling waste. They are disposing all their waste 30Kms far from the city. For an efficient waste management, safe environment and strong financial position, the municipality and private sector should develop a good recycling system of waste.

### **8: Adopting New Technology**

Technology is another more important factor of increasing efficiency and productivity. Kandahar municipality is currently utilizing traditional methods and technology, in various steps of managing waste. The municipality should set up modern technology, in order to enhance efficiency of waste management.

## 9: Research

Research is the initial and most essential way of solving a problem effectively and efficiently. Without research, it is difficult to discover a problem completely. Thus, Kandahar municipality, an organization with low improve research skills of research, should hire professional employees and train their current employees, for developing research environment. It will decrease their costs and will be a good guide to a sound waste management.

## Conclusion

Waste are any material of no use that is regularly generated by the society. It has positive relation with both urbanization and economic activities. The rate of growth is higher than the actions and resources of responsible organizations in many cities. The increasing complexity in the structure of waste, make it more difficult for municipal, to manage things properly. Thus, it is necessary to prevent, reduce and avoid waste rather than, coping with rapid growth of waste continually.

Currently, all most all cities are practicing the same process for managing waste. However, most of these cities are not successful, and they still have to go along way to adopt an efficient waste management. Kandahar city, the second largest city, is also in the list of those cities, which is bothering from the absence of having a well-organized waste management procedure. The municipality of the city, is currently practicing a five steps procedure of collection, transportation, Segregation, recycling and disposing. Yet, the procedure is not that much more mature and efficient, as it is, in other developed cities of the world.

The study focused on waste management to identify consisting problems and offer efficient solution for many problems in connection with waste management. To do so, the study has taken advantage of different valid and reliable techniques to collect, both primary and secondary data from various reliable sources that are directly or indirectly involved in the process of managing waste.

The result discovered, that plastic covers a huge percentage of 45 in the waste, followed by kitchen waste or organic material, containing 30 percent of the total waste generated by household. Moreover, it found that the total amount of daily waste is equal to 800 tons or 725748 Kgs and 0.91kg per capita. The survey showed, that people are not satisfied with current waste management services, because of small number of trash bin compare to households, low frequency of conveyance, waste alongside the bin and some other reasons. The study suggests, that municipality should improve the design and number of trash bins, increase the number of tracks hire more employees, hire a team of evaluation, set up modern technology and improve research skills.

## References

1. A Project of UNDP/OPS & UNOCA. (1991). *Afghanistan KANDAHAR PROVINCE Socio-Economic Profile*. Kabul, Afghanistan: UNIDATA. Retrieved from [http://www.nzdl.org/gsd/collect/areu/Upload/8781/Afghanistan\\_Kandahar\\_province\\_UNIDATA\\_1991.pdf](http://www.nzdl.org/gsd/collect/areu/Upload/8781/Afghanistan_Kandahar_province_UNIDATA_1991.pdf)
2. Amasuomo, E., & Baird, J. (2016). The Concept of Waste and Waste Management. *Journal of Management and Sustainability*, 88-96. Retrieved from [https://www.researchgate.net/publication/311161719\\_The\\_Concept\\_of\\_Waste\\_and\\_Waste\\_Management/fulltext/5b96b1d3299bf147393d60e5/The-Concept-of-Waste-and-Waste-Management.pdf](https://www.researchgate.net/publication/311161719_The_Concept_of_Waste_and_Waste_Management/fulltext/5b96b1d3299bf147393d60e5/The-Concept-of-Waste-and-Waste-Management.pdf)
3. Bhada-Tata, P., & Hoornweg, D. (2012). *What a waste - A Global review of Solid Waste Management*. Washington, DC 20433 USA: Urban Development & Local Government Unit World Bank.



4. Diaz, L. (2016). Solid Waste Management in Developing Countries: Status, Perspectives and Capacity Building. *ntergovernmental Preparatory Meeting for CSD-19* (pp. 1-35). California: CalRecovery, Inc. Retrieved from <https://sustainabledevelopment.un.org/content/documents/ldiaz.pdf>
5. Haziq, M. A., & Panezai, S. (2017). Resources and Environment 2017, 7(2): 49-61 DOI: 10.5923/j.re.20170702.03 An Empirical Analysis of Domestic Water Sources, Consumption and Associated Factors in Kandahar City, Afghanistan. *Resources and Environment* 2017, 7(2), 49-61.
6. India-UNDP Project. (2015). *STRATEGIC ACTION PLAN FOR INTEGRATING DISASTER RISK REDUCTION AND CLIMATE CHANGE ADAPTATION INTO SECTORAL PLAN OF SOLID WASTE MANAGEMENT AT NAVI MUMBAI*. Navi Mumabi: UNPD. Retrieved from [https://www.nmmc.gov.in/c/document\\_library/get\\_file?uuid=c362242d-74c3-4dcf-b0b7-41951e1b08e0&groupId=10156](https://www.nmmc.gov.in/c/document_library/get_file?uuid=c362242d-74c3-4dcf-b0b7-41951e1b08e0&groupId=10156)
7. Joelsson, Y., Lord, R., & 2016. (n.d.). Urban Solid Waste Management in Mumbai Current challenges and future solutions for Urban Development : Minor Field Study. . Royal Institute of Technology, Stockholm. Retrieved from <https://kth.diva-portal.org/smash/get/diva2:943376/FULLTEXT01.pdf>
8. Lamb, G., Pogson, S.-R., & Schliebs, D. (2012). *WASTE DEFINITIONS AND CLASSIFICATIONS*. Sydney: Hyder Consulting Pty Ltd. Retrieved from <http://www.environment.gov.au/system/files/resources/d05aa2d3-be01-44f3-904b-04dd09e9b0a1/files/waste-classification-gaps-part1.pdf>
9. Mishra<sup>1</sup>, A. R., Mishra<sup>2</sup>, S. A., & Tiwari<sup>3</sup>, A. V. (2013). SOLID WASTE MANAGEMENT - CASE STUDY. *International Journal of Research in Advent Technology*, 396-399. Retrieved from [https://www.researchgate.net/publication/262523386\\_SOLID\\_WASTE\\_MANAGEMENT\\_-CASE\\_STUDY/link/0c960537e41209b2b6000000/download](https://www.researchgate.net/publication/262523386_SOLID_WASTE_MANAGEMENT_-CASE_STUDY/link/0c960537e41209b2b6000000/download)
10. Modak, P., Jiemian, Y., Hongyuan, Y., & Mohanty, C. (2012). *Shanghai Manual—A Guide for Sustainable Urban Development in the 21st Century*. Shanghai: United Nations. Retrieved from <https://sustainabledevelopment.un.org/content/documents/shanghaimanual.pdf>
11. Navi Municipal Corporation. (2018). *Reuse of Recycled water in Navi Municipal Corporation Area- A Deatailed Project Report*. Mumbai: Tandon Urban Solution Pvt Ltd. Retrieved from [https://www.nmmc.gov.in/navimumbai/assets/251/2018/11/mediafiles/Part\\_1.pdf](https://www.nmmc.gov.in/navimumbai/assets/251/2018/11/mediafiles/Part_1.pdf)
12. Ogwueleka, T. C. (2012). MUNICIPAL SOLID WASTE CHARACTERISTICS AND MANAGEMENT IN NIGERIA. *Iranian Journal of Environmental Health Science & Engineering (IJEHSE)*, 173-180. Retrieved from <https://eds.b.ebscohost.com/eds/pdfviewer/pdfviewer?vid=0&sid=91bcc125-13d9-471f-bb43-7a3ce2fbdb89%40pdc-v-sessmgr02>
13. Populationstat (Director). (2020). *Kandahar, Afghanistan Population* [Motion Picture]. Retrieved from <https://populationstat.com/afghanistan/kandahar>
14. Rahmani, M. A., & Noori, A. G. (2019). Assessment of Integrated Waste Management Systems in Kandahar City, Afghanistan. *EJERS, European Journal of Engineering Research and Science* Vol. 4, No. 8, August, 63-69. Retrieved from <https://www.ejers.org/index.php/ejers/article/view/1450/606>
15. Saeedi, K. H. (2019). municipal Solid Waste Management Analyzed in Kandahar city. *Octa Journal of Environmental Research*, 10-18. Retrieved from [http://sciencebeingjournal.com/sites/default/files/02\\_0701\\_KS.pdf](http://sciencebeingjournal.com/sites/default/files/02_0701_KS.pdf)
16. Sahil, F. M. (2017). Integrated Solid Waste Management and Development of Analytical Hierarchy Process (AHP) method for Collection and Transportation In Kandahar city, Afghanistan. *International Journal of Scientific & Engineering Research*, 1095-1102. Retrieved from <https://www.ijser.org/researchpaper/Integrated-Solid-Waste-Management-and-Development-of->

Analytical-Hierarchy-Process-AHP-method-for-Collection-and-Transportation-In-Kandahar-city-Afghanistan.pdf

17. Shekdar, A. V. (2009). Sustainable solid waste management: An integrated approach for Asian countries. *Waste Management* 29, 1438–1448. Retrieved from [https://d1wqtxts1xzle7.cloudfront.net/56956400/Sustainable\\_solid\\_waste\\_management\\_-\\_An\\_integrated\\_approach\\_for\\_Asian\\_countries.pdf?1531114157=&response-content-disposition=inline%3B+filename%3DSustainable\\_solid\\_waste\\_management\\_An\\_in.pdf&Expires=1592284112](https://d1wqtxts1xzle7.cloudfront.net/56956400/Sustainable_solid_waste_management_-_An_integrated_approach_for_Asian_countries.pdf?1531114157=&response-content-disposition=inline%3B+filename%3DSustainable_solid_waste_management_An_in.pdf&Expires=1592284112)
18. Shekdar, A. V. (2009). Sustainable solid waste management: An integrated approach for Asian countries. *Waste Management* 29, 1438–1448.
19. Shroder, J. (2008). Afghanistan's development and functionality:Renewing a collapsed state. *GeoJournal* (2007), 91-107. Retrieved from <https://link.springer.com/content/pdf/10.1007/s10708-008-9132-1.pdf>
20. UNEP. (2019, July 04). *Chemical Waste*. Retrieved from The United Nations Environment Programme (UNEP): <https://www.unenvironment.org/news-and-stories/story/building-strong-foundation-responsible-waste-management-afghanistan>
21. UN-HABITAT. (2010). *Solid Waste Management in the World's Cities*. Nairobi: UN-HABITAT. Retrieved from [https://sswm.info/sites/default/files/reference\\_attachments/UN%20HABITAT%202010%20Solid%20Waste%20Management%20in%20the%20Worlds%20Cities.pdf](https://sswm.info/sites/default/files/reference_attachments/UN%20HABITAT%202010%20Solid%20Waste%20Management%20in%20the%20Worlds%20Cities.pdf)
22. Wilson, D. C., Rodic, L., Scheinberg, A., Velis, C., & Alabaster, G. (2010). COMPARATIVE ANALYSIS OF SOLID WASTE MANAGEMENT IN 20 CITIES. *Waste Management & Research*, 2012, 30(3), 1-30. Retrieved from [https://www.researchgate.net/publication/254841786\\_Comparative\\_analysis\\_of\\_solid\\_waste\\_management\\_in\\_cities\\_around\\_the\\_world/link/5915bf950f7e9b70f49da8d6/download](https://www.researchgate.net/publication/254841786_Comparative_analysis_of_solid_waste_management_in_cities_around_the_world/link/5915bf950f7e9b70f49da8d6/download)
23. Zue, D., Asnani, p., Zurbrügg, C., Anapolsky, S., & Mani, S. (2008). *Improving Municipal Solid Waste Management in India - A Sourcebook for Policy Makers and Practitioners*. Washington, D.C: The World Bank. Retrieved from <https://hvtc.edu.vn/Portals/0/files/636191337416342988ImprovingMunicipalSolidWasteManagementinIndiaASourcebookforPolicymakersandPractitioners.pdf>